# MIGRATION RECORDS OF BUTTERFLIES (LEPIDOPTERA: PAPILIONIDAE, HESPERIIDAE, PIERIDAE, NYMPHALIDAE) IN THE 'TOP END' OF THE NORTHERN TERRITORY

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## Abstract

New records of butterfly migration in the 'Top End' of the Northern Territory concerning six species, *viz*: *Papilio demoleus* Linnaeus, 1758 (Papilionidae), *Badamia exclamationis* (Fabricius, 1775) (Hesperiidae), *Catopsilia scylla* (Linnaeus, 1763), *Eurema hecabe* (Linnaeus, 1758), *Belenois java* (Linnaeus, 1768) (Pieridae) and *Junonia hedonia* (Linnaeus, 1764) (Nymphalidae), are presented based on data accumulated over the period 2005-2015. In four species for which multiple records were obtained over different years, patterns of migration were remarkably consistent in terms of flight direction and season, with predominantly northerly movements in September-October (*B. java*), January-April (*B. exclamationis*) and April-May (*C. scylla* and *J. hedonia*).

## Introduction

Migration, the purposeful movement of individuals in one general direction over a large area relative to the geographical range of the species, is a fundamental component of the life history strategy of butterflies that track seasonal changes in resources (*e.g.* larval food plants, breeding habitats) or aggregate in non-breeding (*e.g.* overwintering) sites (Dingle 1996). Smithers (1978, 1983a, 1983b, 1985) provided a comprehensive review and presented a substantial amount of new data on the species that are known or suspected to be regular migrants in Australia. Dingle *et al.* (1999, 2000) subsequently analysed this dataset, which also included additional records gleaned from the literature, to determine if there were general consistent patterns in both timing and direction, and examined possible ecological factors accounting for seasonal shifts in geographical range. For eastern Australia, where most migration data of butterflies has been assembled, they found that latitude, rainfall patterns and soil moisture were the main determinants.

However, Dingle *et al.* (1999) noted that for a number of migratory butterflies in Australia, such as *Papilio demoleus* Linnaeus, 1758, too few observations were available to draw general conclusions on orientation and seasonal timing of migration and called for more data on these species. Moreover, comparatively little data are available for the monsoon tropics of northwestern Australia. Smithers and McArtney (1970) recorded hundreds of specimens of *P. demoleus sthenelus* W.S. Macleay, 1826 flying south-east over a distance of 25 km across the Stuart Highway between Elliott and Renner Springs, NT, in May 1969. Grund and Hunt (2001) noted adults of *Elodina padusa* (Hewitson, 1853) migrating in large numbers in a southerly direction on the Mitchell Plateau in the Kimberley, WA, sometime between late June and mid July 2000. Braby (2014) documented a temporary range

expansion of *Danaus plexippus* (Linnaeus, 1758) in the western Gulf Country (northwestern Qld-NT) and central Australia (NT), in which small numbers were observed flying north, north-west or west during May 2013. He also summarised records of *Catopsilia pyranthe crokera* (W.S. Macleay, 1826) in the Darwin area and from nearby locations, a region in which the species is normally absent, and concluded that the species is a rare seasonal immigrant to the northern coastal parts of the 'Top End', with influxes likely to occur in March-April and less frequently during June-August and in December.

Here, I present new data on movements concerning six species of butterflies, based on records from the 'Top End' of the Northern Territory. Of particular interest are the first records of *Catopsilia scylla etesia* (Hewitson, 1867) and *Junonia hedonia zelima* (Fabricius, 1775) as migrants in Australia.

## Methods

Observations on butterfly movement in the 'Top End' of the Northern Territory were made opportunistically over a 10-year period during 2005-2015. Most observations were made between Darwin and Katherine but some were further afield. Most observations were qualitative but on eight occasions attempts were made to quantify the adult density of the migration; this was done by counting the number of individuals crossing a transect of defined length over a short period of time. There are currently no standardised protocols in Australia for quantifying butterfly migrations in terms of time (number of minutes and time of day), space (transect length) and number of repeat samples needed to estimate the arithmetic mean and variance around the mean. In this paper, the time period during which butterflies were counted varied from 9-45 mins (average 18 mins) and counts were conducted on still, sunny days, mainly around midday from 1145-1330 h, although one count was made during the morning from 0950-1000 h. The length of the transects over which butterflies traversed varied from 10-50 m but was usually 20-50 m. Repeated counts were not made to estimate the mean and standard deviation of the numbers migrating. The migration rate or density was then subjectively classified into one of four class-intervals irrespective of transect length: small (<1 adult per minute), moderate (1 adult per minute), large (1-10 adults per minute) and very large (>10 adults per minute).

## Observations

### PAPILIONIDAE

*Papilio demoleus* Linnaeus, 1758, Chequered Swallowtail

A large-scale movement of this species was observed in February 2015, the only migration recorded over the 10-year period (Table 1). The migration lasted for just under two weeks and appeared to peak around 4-5 February. Adults were mostly in fresh condition and flew rapidly within 3 m of the ground, between mid morning and mid afternoon. The flight extended over a relatively large area, with records from offshore areas of Cobourg Peninsula,

**Table 1.** Migration and associated records for *Papilio demoleus* in the Northern Territory.

| Location | Date | Observer | Direction | Comments |
|---|---|---|---|---|
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 2 Feb. 2015 | M.F. Braby | ESE | Small numbers flying rapidly around midday. |
| Darwin northern suburbs (Bullocky Point-Wanguri), NT | 3 Feb. 2015 | M.F. Braby | ESE | Large numbers flying rapidly between 0900-1300 h. Many adults captured were freshly emerged, but others were worn. |
| Bees Creek, NT (12°34'S, 131°03'E) | 4 Feb. 2015 | G. Ainsworth | | Influx of adults recorded on rural block, not previously recorded during past 12 years. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 4-5 Feb. 2015 | M.F. Braby | E (NE-SE) | Very large numbers flying rapidly, mainly E, from 0830 h to mid to late afternoon. |
| Darwin eastern suburbs (Wanguri-Palmerston), NT | 6 Feb. 2015 | M.F. Braby | E (ESE-SE) | Small numbers flying rapidly, mainly E. |
| Holmes Jungle CP, Darwin, NT (12°24'S, 130°55'E) | 6 Feb. 2015 | T. Ratnayeke | | Influx of many adults observed at Holmes Jungle and Karama; mostly freshly emerged. |
| Mt Burrell, Tipperary Station, NT (13.49623°S, 131.03572°E) | 7 Feb. 2015 | M.F. Braby | SSW | Large numbers flying between 0930-1130 h. |
| 6 km NW of Robin Falls, NT (13.34119°S, 131.11801°E) | 7 Feb. 2015 | M.F. Braby | SSW | Moderate numbers flying rapidly from midday to mid afternoon (1/min/50m: 1305-1315 h). |
| Cobourg Peninsula, NT | 8 Feb. 2015 | A. Withers | W | Many adults flying over ocean 10 nautical miles offshore. |
| Darwin northern suburbs (CBD-Wanguri), NT | 8-10 Feb. 2015 | M.F. Braby | S (SSW-SW) | Small numbers flying rapidly, mainly S, between 0830-1000 h. |
| Humpty Doo, NT (12°34'S, 131°06'E) | 10 Feb. 2015 | D. Binns | | Influx of many adults observed in rural area, as well as suburbs of Darwin. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 11-12 Feb. 2015 | M.F. Braby | S or W | Small numbers flying rapidly (0.1/min/50m: 1300-1330 h). |
| 6.5 km N of Berry Springs, NT (12.64514°S, 131.00986°E) | 14 Feb. 2015 | M.F. Braby | W | Few adults flying between 1200-1330 h. |

Darwin suburban and rural areas and the Mt Burrell-Robin Falls area to the south-west of Adelaide River. Curiously, the direction of flight shifted progressively from an easterly, through southerly to finally a westerly direction during the course of the migration period. At Darwin, for example, adults flew predominantly east near the start of the migration (3-5 February), when immense numbers of butterflies were observed flying rapidly across suburban streets, parks and gardens, rarely pausing to stop to feed from flowers; however, towards the end of the migration (8-12 February) they flew mainly south or west and in considerably lower numbers.

## HESPERIIDAE

### *Badamia exclamationis* (Fabricius, 1775), Narrow-winged Awl

Small to moderate numbers of this species were recorded migrating on four separate occasions (in different years) between late January and early April, particularly in March and early April (Table 2). In general, adults flew rapidly 3-5 m or more above ground in a northerly direction (with the direction of flight varying from NW, NNE to ENE) between mid morning and early afternoon. The only exception to this general pattern was a southerly flight (SSW) recorded in late January 2011. However, despite careful surveillance during subsequent days at this site no further adults were detected flying south in January.

## PIERIDAE

### *Catopsilia scylla* (Linnaeus, 1763), Orange Migrant

Observations on directional flight of this species were made on three separate occasions (in different years) in the more inland areas (Table 3). In general, small to moderate numbers were observed flying rapidly in a northeasterly direction (with the direction of flight varying from N, NE to E) between mid April and early May. No quantitative estimates were made on adult density or time of day.

### *Eurema hecabe* (Linnaeus, 1758), Large Grass-yellow

Only one record of migration was made for this species, in April 2015, when large numbers were observed flying east during early afternoon (Table 3). They flew very close to the ground, within about 1 m.

### *Belenois java* (Linnaeus, 1768), Caper White

Migration of this species in the Darwin area was observed on four separate occasions (in different years) between late September and mid October during the early afternoon (Table 3). In general, adults flew in a north to northwesterly direction and generally small numbers were involved but, in 2009, a substantial flight involving moderate numbers of adults that lasted for four days was observed. On three of these occasions (2005, 2007, 2009) the migrations were associated with subsequent breeding, in which considerable numbers of immature stages (eggs, larvae and pupae), as well as adults, were

detected on the larval food plants, namely the vine *Capparis sepiaria* (Capparaceae) growing in nearby coastal monsoon vine thicket, or cultivated trees of *C. umbonata* in suburban parks and nature strips. The breeding often continued for several months (up until December or January), during which several overlapping generations were completed.

**Table 2.** Migration records for *Badamia exclamationis* in the Northern Territory.

| Location | Date | Observer | Direction | Comments |
|---|---|---|---|---|
| Rapid Creek, Darwin, NT (12.38083°S, 130.86462°E) | 8 Mar. 2008 | M.F. Braby & D.C. Franklin | ENE | Moderate numbers flying rapidly during morning (1/min/30m: 0950-1000 h). |
| Leanyer Sewage Ponds, Darwin, NT (12°21'S, 130°54'E) | 8 Mar. 2008 | M.F. Braby & D.C. Franklin | ENE | Small numbers flying rapidly at 1100 h. |
| 30 km SE of Pine Creek, NT (14.06290°S, 131.97026°E) | 15 Mar. 2008 | M.F. Braby | N–NNE | Moderate numbers flying rapidly across Stuart Hwy during late morning (1/min/20m: 1145-1200 h). |
| Bullocky Point, Darwin, NT (12.43777°S, 130.83377°E) | 27 Jan. 2011 | M.F. Braby | SSW | Moderate numbers flying rapidly during midday (1/min/30m: 1200-1245 h). |
| Dundee Beach, NT (12.76420°S, 130.35324°E) | 1 Apr. 2012 | M.F. Braby | NNE | Small numbers flying rapidly between 1000-1100 h. |
| Parap, Darwin, NT (12°26'S, 130°50'E) | 5 Apr. 2012 | M.F. Braby | NE | Small numbers flying rapidly during early afternoon (0.3/min/10m: 1300-1310 h). |
| Holmes Jungle CP, NT (12°24'S, 130°55'E) | 31 Jan. 2015 | M.F. Braby | NW | Small numbers flying rapidly between 1030-1130 h. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 1 Feb. 2015 | M.F. Braby | NW | Small numbers flying rapidly between 1000-1030 h. |

## NYMPHALIDAE

### *Junonia hedonia* (Linnaeus, 1764), Chocolate Argus

Migration of this species was observed on four separate occasions (in different years) in the more inland areas (Table 4). In general, small to moderate numbers of adults flew rapidly 2-3 m above the ground in a northerly direction (with the direction of flight varying from N, NNE to NE)

between mid April and early May, from late morning to early afternoon. In 2012, a series of observations were made over a 13-day period between 22 April and 4 May, in which large numbers of adults were recorded, indicating that migration lasted for approximately two weeks.

**Table 3.** Migration records for *Catopsilia scylla, Eurema hecabe* and *Belenois java* in the Northern Territory.

| Location | Date | Observer | Direction | Comments |
|---|---|---|---|---|
| | | ***Catopsilia scylla*** | | |
| 1.6 km NNW of Pine Creek, NT (13.80997°S, 131.82852°E) | 1 May 2010 | M.F. Braby & L.J. Aitchison | N | Small numbers flying rapidly around midday. |
| Dunmarra–50 km SSE of Elliott, NT | 7 May 2013 | M.F. Braby | E | Very small numbers flying rapidly across Stuart Hwy over a distance of *c.* 150 km. |
| Katherine Gorge campground, Nitmiluk NP, NT (14.31803°S, 132.42026°E) | 15 Apr. 2014 | M.F. Braby & L.J. Aitchison | NE | Moderate numbers flying rapidly. |
| | | ***Eurema hecabe*** | | |
| Noonamah-Adelaide River, NT | 3 Apr. 2015 | M.F. Braby & L.J. Aitchison | E | Large numbers flying across Stuart Hwy during early afternoon over a distance of *c.* 70 km (4.9/min/50m: 1321-1330 h). |
| | | ***Belenois java*** | | |
| Darwin CBD, NT (12°27'S, 130°50'E) | 17 Oct. 2005 | M.F. Braby | NW | Small numbers flying during early afternoon. |
| CSIRO complex Berrimah, Darwin, NT (12°24'48"S, 130°55'19"E) | 3 Oct. 2007 | M.F. Braby | NW | Small numbers flying rapidly at 1240 h. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 12 Oct. 2008 | M.F. Braby | N | Small numbers flying rapidly at 1250 h. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 29 Sep. 2009 | M.F. Braby | NNW | Moderate numbers flying rapidly during early afternoon between 1200-1500 h) (1/min/10m: 1215-1230 h). Migration continued for next three days but in substantially smaller numbers and ceased by 3 Oct. 2009. |

**Table 4.** Migration records for *Junonia hedonia* in the Northern Territory.

| Location | Date | Observer | Direction | Comments |
|---|---|---|---|---|
| 1.6 km NNW of Pine Creek, NT (13.80997°S, 131.82852°E) | 1 May 2010 | M.F. Braby & L.J. Aitchison | N | Small numbers flying rapidly. |
| Wanguri, Darwin, NT (12.37308°S, 130.88657°E) | 2 May 2010 | M.F. Braby | N | One flying very rapidly during early afternoon. |
| 1.6 km NNW of Pine Creek, NT (13.80997°S, 131.82852°E) | 8 May 2010 | M.F. Braby & S. Keates | N | Small numbers flying rapidly during late morning. |
| Adelaide River-Douglas Daly Research Farm, NT | 22 Apr. 2012 | M.F. Braby | NNE | Large numbers flying rapidly over a distance of *c.* 100 km between 1200-1430 h. |
| Mt Muriel, Fish River Station, 7 km SSW of Douglas Daly Research Farm, NT (13.89433°S, 131.15822°E) | 23 Apr. 2012 | M.F. Braby | NE | Large numbers flying rapidly between 1200-1400 h. |
| Fish River Station, 6 km S of Daly River (Nauiyu), NT (13.80356°S, 130.69644°E) | 27 Apr. 2012 | M.F. Braby | NE | Small numbers flying between 1230–1330 h. |
| Noonamah-Acacia, NT | 4 May 2012 | M.F. Braby | NE | Large numbers flying rapidly across Stuart Hwy over a distance of *c.* 20 km between 1115-1130 h. |
| Adelaide River-Pine Creek, NT | 6 May 2013 | M.F. Braby | N | Large numbers flying across Stuart Hwy over a distance of *c.* 100 km during early afternoon. |
| Marrakai Rd, 2.5 km E of Stuart Hwy, NT (12.90468°S, 131.16080°E) | 19 Apr 2015 | M.F. Braby & D. Bisa | N | Small numbers flying rapidly between 1130–1300 h. |

## Discussion

Of the six species reported here as displaying migratory behaviour in the Northern Territory, four (*Papilio demoleus, Badamia exclamationis, Eurema hecabe* and *Belenois java*) are well-known migrants elsewhere in Australia (see Smithers 1978, 1983a, 1983b, 1985, Dingle *et al.* 1999) but, for the two other species (*Catopsilia scylla* and *Junonia hedonia*), there appear to be no previous records of migration in Australia. Interestingly, for the four species for which multiple records were obtained over different years (*B. exclamationis*, *C. scylla*, *B. java* and *J. hedonia*), the patterns of migration were remarkably consistent both in terms of direction of flight and time of year. Thus, all these species were observed flying in a predominantly northerly direction, with *B. java* in September-October, *B. exclamationis* mainly in March-April, and *C. scylla* and *J. hedonia* in April-May. This suggests that seasonal movement in these species is a regular component of their life history in northwestern Australia.

With the exception of *B. java*, the significance of migration in this set of species remains to be determined. *Belenois java* was the only species for which migration was clearly associated with breeding. My long-term observations at Darwin indicated that the species usually appeared each year during the 'build-up' and early wet season (*i.e.* September-December), but it was generally absent during the rest of the year. Similarly, Meyer *et al.* (2006) recorded this species in the Darwin area only in September. However, in 2010 an influx of the species was recorded in late March that was followed by breeding, with immature stages comprising numerous clusters of eggs and first instar larvae being detected on *Capparis sepiaria* at Bullocky Point; however, the direction of flight on this occasion was not apparent. Interestingly, Dingle *et al.* (1999) commented that all reports of directional flight for *B. java* in Australia were in 'spring' and that migrations in northeastern Australia (Qld) were predominantly north or east, in contrast with those in southern Australia (NSW, Vic) which were south or west. These findings are consistent with those in the NT, suggesting that northerly migrations in northwestern Australia may be characteristic of this species.

Movement in *B. exclamationis* may also be associated with colonisation of breeding habitats, similar to that reported in Queensland (Burns 1933, Smithers 1978, Valentine 2004). However, the breeding habitat/range of this species is not well understood in northwestern Australia. The only documented breeding record is from the lower rainfall areas of the eastern Kimberley where the immature stages of *B. exclamationis* were found on *Terminalia microcarpa* (Combretaceae), which grew in abundance in riparian monsoon vine thicket at Black Rock Falls track near Kununurra, WA, in December (Meyer 1996 and pers. comm.). Kununurra is located approximately 430 km SSW of Darwin and, moreover, this was the same direction of flight observed at Darwin in late January 2011. Thus, the

southerly flight recorded in January at Darwin might have been the arrival of an immigrant population (possibly originating from mainland New Guinea) dispersing to the breeding areas in the eastern Kimberley; the northerly flights recorded in January-April (particularly in March-April) might well comprise a return flight of the next generation. The timing of these migrations probably vary with the season and start of the monsoon and further observations are needed to establish if there are regular southward migratory flights earlier in the season, in October-December. Smithers (1978) reported considerable variation in the timing of movements for the species in Queensland, particularly the southbound flight.

Migration in both *J. hedonia* and *C. scylla* consistently occurred at the end of the wet season but the reason for such population movements was not established. Presumably, adults disperse from the more inland areas to exploit breeding habitats in the coastal or near coastal areas of the 'Top End' that only become available at the start of the dry season. For example, *J. hedonia* breeds in floodplain wetlands (on the annual herb *Hygrophylla angustifiolia* in paperbark swamps), which are typically inundated during the wet season. It is likely that the larval food plant grows rapidly during this period so that by the start of the dry season the plants have copious foliage that is ready to be exploited by *J. hedonia* larvae.

In the case of *C. scylla*, Braby (2000) speculated that it was migratory based on its seasonal appearance over much of its range, but noted that no details on adult movements in Australia had been published. Moreover, there are no confirmed reports of migration of the species in South-East Asia (Yata 1985, van der Poorten and van der Poorten 2012), despite its common name 'Orange Migrant' or 'Orange Emigrant'. At Darwin, breeding was noted to be seasonal, with the immature stages (eggs and larvae) usually recorded around March-May and again in September-November (on *Senna surattensis* in monsoon vine thicket or suburban gardens). Similarly, Meyer *et al.* (2006) noted that *C. scylla* was seasonal in Darwin, with adults recorded only during March-May. Its regular seasonal appearance in Darwin suggests the arrival of migratory populations at the end of the wet season.

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**References**

BRABY, M.F. 2000. *Butterflies of Australia. Their identification, biology and distribution.* CSIRO Publishing, Collingwood, Melbourne; xx + 976 pp.

BRABY, M.F. 2014. Remarks on the spatial distribution of some butterflies and diurnal moths (Lepidoptera) in the Top End of the Northern Territory, Australia. *Northern Territory Naturalist* **25**: 29-49.

BURNS, A.N. 1933. The migratory skipper (*Badhamia* [sic] *exclamationis* Fabr.). *The Victorian Naturalist* **49**: 225-228.

DINGLE, H. 1996. *Migration. The biology of life on the move*. Oxford University Press, New York; 480 pp.

DINGLE, H., ROCHESTER, W.A. and ZALUCKI, M.P. 2000. Relationships among climate, latitude and migration: Australian butterflies are not temperate-zone birds. *Oecologia* **124**: 196-207.

DINGLE, H., ZALUCKI, M.P. and ROCHESTER, W.A. 1999. Season-specific directional movement in migratory Australian butterflies. *Australian Journal of Entomology* **38**: 323-329.

GRUND, R. and HUNT, L. 2001. Some butterfly observations for the Kimberley and Tanami regions, Western Australia. *Victorian Entomologist* **31**: 19-23.

MEYER, C.E. 1996. Butterfly larval food plant list for the Northern Territory and the Kununurra District in Western Australia. *Victorian Entomologist* **26**: 66-72.

MEYER, C.E., WEIR, R.P. and WILSON, D.N. 2006. Butterfly (Lepidoptera) records from the Darwin region, Northern Territory. *Australian Entomologist* **33**: 9-22.

SMITHERS, C.N. 1978. Migration records in Australia. 2. Hesperiidae and Papilionidae (Lepidoptera). *Australian Entomological Magazine* **5**: 11-14.

SMITHERS, C.N. 1983a. Migration records in Australia. 3. Danainae and Acraeinae (Lepidoptera: Nymphalidae). *Australian Entomological Magazine* **10**: 21-27.

SMITHERS, C.N. 1983b. Migration records in Australia. 4. Pieridae (Lepidoptera) other than *Anaphaeis java teutonia* (F.). *Australian Entomological Magazine* **10**: 47-54.

SMITHERS, C.N. 1985. Migration records in Australia. 5. Lycaenidae and Nymphalidae (Lepidoptera). *Australian Entomological Magazine* **11**: 91-97.

SMITHERS, C.N. and MCARTNEY, I.B. 1970. Record of a migration of the Chequered Swallowtail *Papilio demoleus sthenelus* Macleay (Lepidoptera: Papilionidae). *North Queensland Naturalist* **37**: 8.

VALENTINE, P.S. 2004. The demise of mass migration of the Brown Awl *Badamia exclamationis* (Fabricius 1775) (Lepidoptera: Hesperiidae): a consequence of land clearing in Queensland? *Pacific Conservation Biology* **10**: 67-69.

VAN DER POORTEN, G. and VAN DER POORTEN, N. 2012. *Catopsilia scylla* (Linnaeus, 1763): a new record for Sri Lanka with notes on its biology, life history and distribution (Lepidoptera: Pieridae). *Journal of Research on the Lepidoptera* **45**: 17-23.

YATA, O. 1985. Part 1: Pieridae. Pp 205-438, in: Tsukada, E. (ed) *Butterflies of the South East Asian islands. II: Pieridae, Danaidae*. Plapac, Tokyo.